AR 710

Groundwater Monitoring Evaluation
Pine Bluff Arsenal (PBA)
Pine Bluff, Arkansas
EPA I.D. NO. AR0213820707

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SUMMARY

The groundwater monitoring program at Pine Bluff Arsenal (PBA) has been evaluated following a three day visit and record review, during October 21-23, 1985. Analysis of the available water quality data indicates that the present monitoring system at the 1983 Landfill does not meet the requirements of 40 CFR 264.97 Subpart F of RCRA regulations for permitted sites. RCRA 264.97(a) of the Subpart F requires the owners and operators of the permitted facilities to develop a groundwater monitoring system with sufficient number of wells, at appropriate locations and depths, to yield samples representative of the groundwater in the uppermost aquifer. The monitoring system should be adequate to detect and measure hazardous constituents in the uppermost aquifer at the point of compliance.

Discussion regarding other permitted sites (Incinerator Lagoon and the Surface Run-off Control Impoundment) can be found in the background section. The inadequacies at PBA include:

1983 LANDFILL:

° LEAD CONTAMINATION

1) The October 1985 laboratory results indicate lead (Pb) contamination in Wells 183 and 185.

° WELL 181

1) The position of the sand pack in this downgradient well is not at an appropriate depth therefore, Well 181 does not yield samples that are representative of the groundwater passing the point of compliance.

2) The design of Well 181 is inadequate because the water table zone is unmonitored by the sand pack which violates the well design specified in the permit (Permit, Attachment 9, Appendix F).

40 CFR 264.97(a)(2) states that the monitor wells must be installed at the appropriate depth in order to yield samples that are representative of the groundwater passing the point of compliance.

° WELL 182 and WELL 183

1) Both wells have abnormally high pH values which are interpreted as resulting from contamination of the groundwater due to an inadequate annular seal.

40 CFR 264.97(c) states that the annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater.

2) Since the inadequate annulur seal has resulted in contamination, the water quality data obtained from Well 182 and Well 183 does not represent true ground water quality or background quality.

40 CFR 264.97(a)(2) states that the monitor wells must represent the quality of the groundwater passing the point of compliance.

° WELL 184

This well is inadequate for the detection and measurement of hazardous constituents passing the point of compliance due to the excessive length of its sand pack (39 feet).

40 CFR 264.97(b) states that the monitor wells must be able to detect and measure hazardous constituents passing the point of compliance.

° VIOLATION OF SAMPLING PLAN

The monitoring system is inadequate for the effective collection of volatiles (chlorobenzene) which results in unreliable groundwater quality data and violates the sampling plan described in the permit.

40 CFR 264.97(d) states that the monitoring program must include sampling procedures that result in reliable ground water quality data.

° TWO POSSIBLE INADEQUACIES:

1. Sand Packs Are Too Long Which Reduces The Monitor Wells Ability To Detect Hazardous Constituents Passing The Point of Compliance.

40 CFR 264.97(b) states that the monitor wells must be able to detect and measure hazardous constituents passing the point of compliance.

2. The Facility May Have Inadequately Defined The Uppermost Aquifer At This Site.

40 CFR 270.14(c)(2) states that the Part B applicant must identify the uppermost aquifer and aquifers hydraulically interconnected beneath the facility property.

SURFACE RUN-OFF CONTROL IMPOUNDMENT

° Groundwater contamination is indicated at this site by the presence of high levels of TOC, TOX, chlorobenzene, and highly variable pH in some wells. This contamination, however, could be emanating from another PBA site.

INCINERATOR LAGOON (SITE 40A)

° Groundwater contamination is indicated at this site by the August 1984 sampling which indicated elevated levels of chromium, mercury, iron, and acidic pH levels. However, this site was deleted from the Part A notification in October 1984 and is not RCRA regulated. The State will do the Preliminary Assessment Site Investigation at PBA.

° Remedial action appears to be needed at this unregulated unit.

RECOMMENDATIONS

Incinerator Lagoon (Site 40A)

° EPA may issue a §3007 letter requesting that PBA provide EPA with the rationale and supporting data for deleting the incinerator lagoon (Site 40A) from the Part A notification.

Surface Run-off Control Impoundment

° The surface run-off control impoundment should be moved into the assessment phase of groundwater monitoring to determine the extent of groundwater contamination that could be emanating from Sites 7, 11, or another site.

1983 Landfill

° Two additional wells should be required to determine whether the lead contamination originates from PBA or from adjacent property not owned by PBA. These wells should be located hydraulically upgradient from the present upgradient wells and as close as possible to the PBA property line.

° Wells 182 and 183 should be replaced with new RCRA monitor wells.

° Well 181 should be replaced with a new RCRA well that monitors the water table zone (as required in the permit) and the more permeable sandy zone which intersects the October 1985 water table.

° Well 184 should be removed from the groundwater monitoring system but it is not necessary to replace it with a new RCRA well.

° Water quality data collected from Wells 182 and 183 is invalid and should not be used to establish background groundwater quality.

- The background water quality, arithmetic mean, and variance should be recalculated without data from Wells 182, 183, and 184.

- The facility should not use the present system to monitor chlorobenzone or other volatiles.

- No enforcement action is necessary at this time regarding the excessive length of the sand packs which limits the ability of the entire monitoring system to detect contaminants.

- If contamination is detected at the 1983 Landfill site, PBA should be required to.

    1) Install groups of wells to monitor various depths of the uppermost aquifer including the lower portion which is presently unmonitored.

    2) If the contamination plume is detected to the east of the Landfill, install wells in the alluvial deposit which is located to the east of the Landfill.

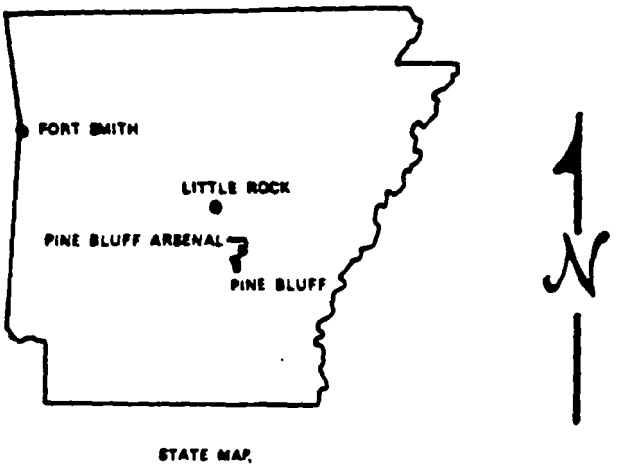
    3) If contamination is detected at the base of the uppermost aquifer, install wells to monitor the aquifer that underlies the clay aquitard (unless adequate pump tests demonstrate that the clay aquitard prevents water in the uppermost aquifer from moving into the aquifer that underlies the clay aquitard).

BACKGROUND OF PBA

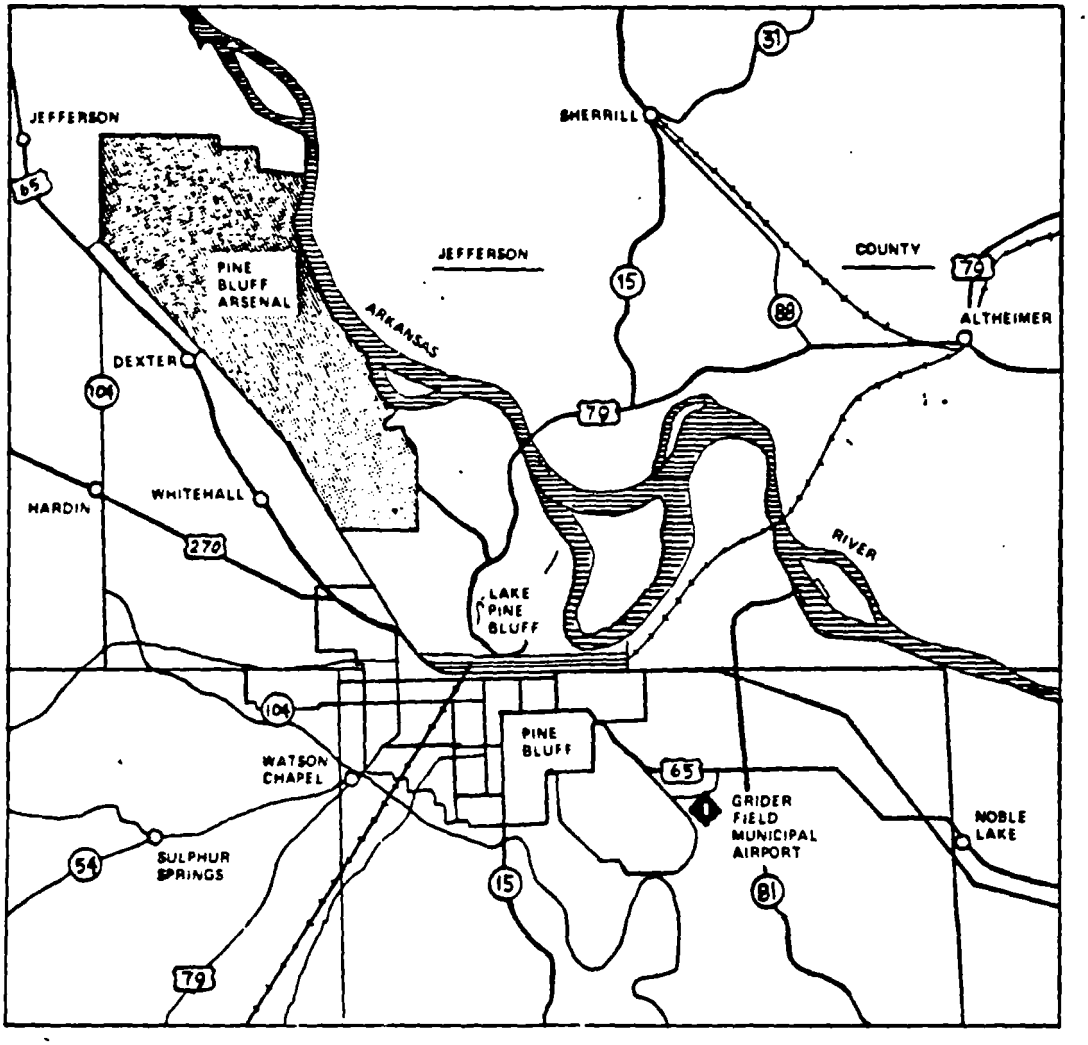
The PBA was established by the war department in 1941. During the 40's and 50's chemicals such as chlorine, mustard, lewisite, caustic, chlorobenze and biologically active products were produced. These chemicals were used in the manufacture of incendiary bombs, riot control agents, and incapaciting agents. The production of biologically active products was discontinued in early 70's. The figures 1 and 2 show the location of PBA. The production at PBA can be grouped into three main categories.

(i) Pyrotechnics
(ii) Chemical Manufacturing
(iii) Biological operations (Inactive)

Figure 1



STATE MAP



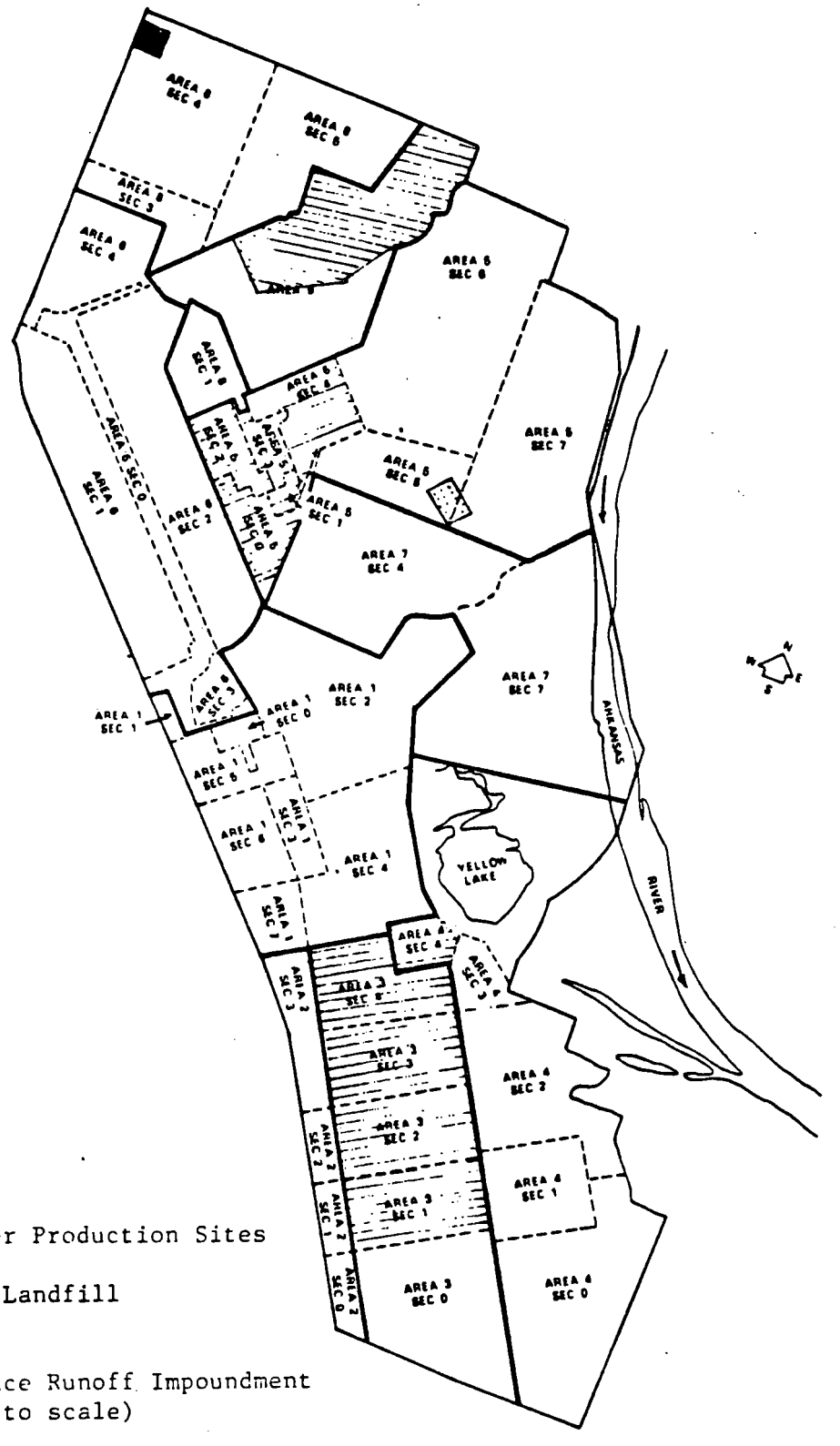
LOCATION MAP

5 0 5

SCALE OF MILES

SITE MAP FOR PINE BLUFF ARSENAL, PINE BLUFF, ARKANSAS

Figure 2



Former Production Sites

1983 Landfill

Surface Runoff Impoundment
(Not to scale)

AREAS AND SECTIONS OF PINE BLUFF ARSENAL

The pyrotechnics are located in area 3, the chemical manufacturing in area 5 and inactive biological operations in area 9. Each of these production areas has contributed to the contamination at PBA. The area surrounding the old chemical manufacturing is most heavily contaminated due to the production of lewisite, sulfer monochloride, chlorine, arsenic trichloride and organic polymers. Both the buildings and surrounding soil have shown contamination. The soil and rubble will be removed and placed in the demolition cells 1 and 2 of the landfill. (see figure 3) The pyrotechnic area has high contaminatioin due to phosphorus, sodium and phosphates in addition to various kinds of acids, organic chemicals and inorganic salts. This waste will also be placed in cells 1 and 2 of the landfill. The wastes from the biological operations were sterilized prior to incineration. The resulting wastes were treated in a conventional waste water treatment plant. The sludge from the treatment plant was placed along powerlines at the site.

The landfill consists of three cells. Two cells of 220x400 feet will contain demolition wastes from the oil chemical, pyrotechnic areas. Cell three, 200x230 feet, will contain production wastes from current operations.

The PBA has other areas within their boundaries that contain CERCLA wastes. These wastes will be placed in a proposed 1986 landfill, south of the 1983 landfill. A permit application for this landfill is being currently reviewed.

Incinerator Lagoon

The incinerator lagoon (Site 40A) is not RCRA regulated and has been deleted from the Part A notification (letter from Richard Quinn, dated October 17, 1984). However, during review of second quarter (August 1984), groundwater sampling data, it was noted that groundwater results indicate contamination at this site according to the EPA Primary Drinking Water Standards.

PBA reported that the first quarter (January 1983) sampling indicated that the Primary Drinking Water Standard was exceeded for cadmium, but was not exceeded during the second quarter.

The second quarter sampling (August 1984) indicated that the Primary Drinking Water standards were exceeded for elevated levels of chromium and mercury and the EPA secondary Drinking Water Standards were exceeded for iron and pH. The pH is abnormally low and acidic. The elevated values for the second quarter are as follows:

	Primary Standards	Well 173	Well 174	Well 175	Well 176
Mercury	0.002 mg/l			0.003 mg/l	
Chromium	0.05 mg/l	1.214 mg/l	0.137 mg/l		
	Secondary Standards				
Iron	0.3 mg/l	1.10 mg/l	1.34 mg/l	5.73 mg/l	
pH	6.5-8.5	5.0	5.1	5.3	4.9

The EPA and the state should re-examine the exemption of this site from Part A notification. The EPA may issue a §3007 letter requesting that PBA provide EPA with the rationale and supporting data for deleting this site from the Part A notification.

Surface Run-off Control Impoundment:

The surface run-off control impoundment was mistakenly considered to be a non-RCRA unit and therefore was not thoroughly evaluated during the inspection. This permitted impoundment (Figures 3 and 4) collects the run-off from soils around the chemical munition storage areas. PBA has installed a groundwater monitoring network around this impoundment.

Upon brief review of the water elevation, soil bore log, and well completion data submitted during and after the inspection, the following deficiency was noted: well completion logs were missing for Wells 189, 190, 191, and 192.

During the file review of the groundwater quality data (Groundwater Quality Background Assessment of the Run-off Control Impoundment, October 1985 by the Army Corps of Engineers) it was noted that the March 1985 groundwater sampling indicated groundwater contamination. This contamination is evidenced by low levels of organic compounds (pesticides) and elevated levels of chlorobenzene, TOC, and TOX. In addition, the pH values varied widely (5.6 - 11.6) which could indicates either improper well construction, improper sampling techniques, or groundwater contamination.

Groundwater sampling in August 1984 indicated that Well 190 (0.0570 mg/l) and Well 191 (0.0590 mg/l) contained lead in amounts that exceeded the EPA Primary Drinking Water Standard which is 0.050 mg/l. However, subsequent quarterly sampling has not exceeded the Primary Standard for lead.

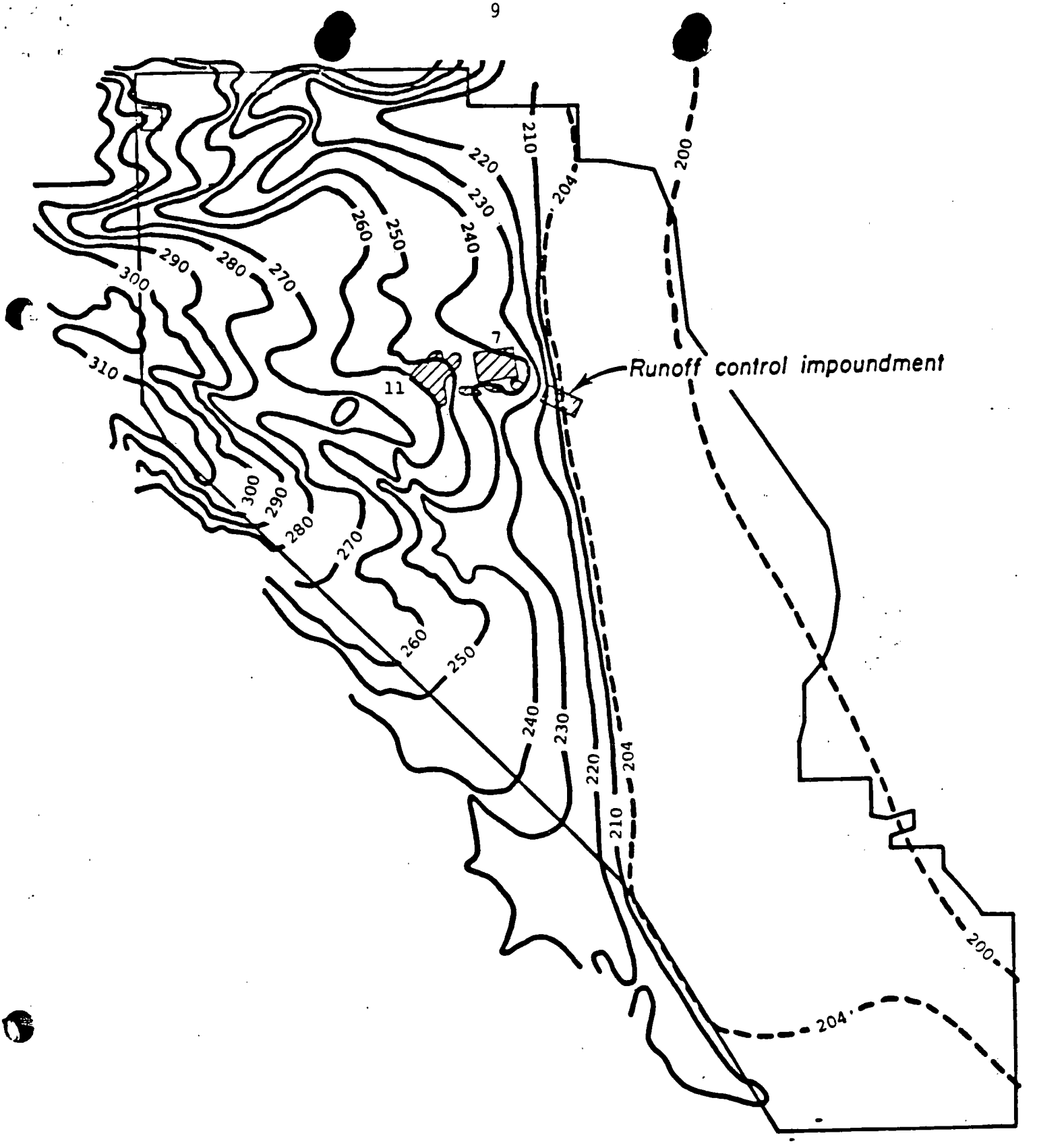


Figure 3. Location map showing the runoff control impoundment and the regional water table.

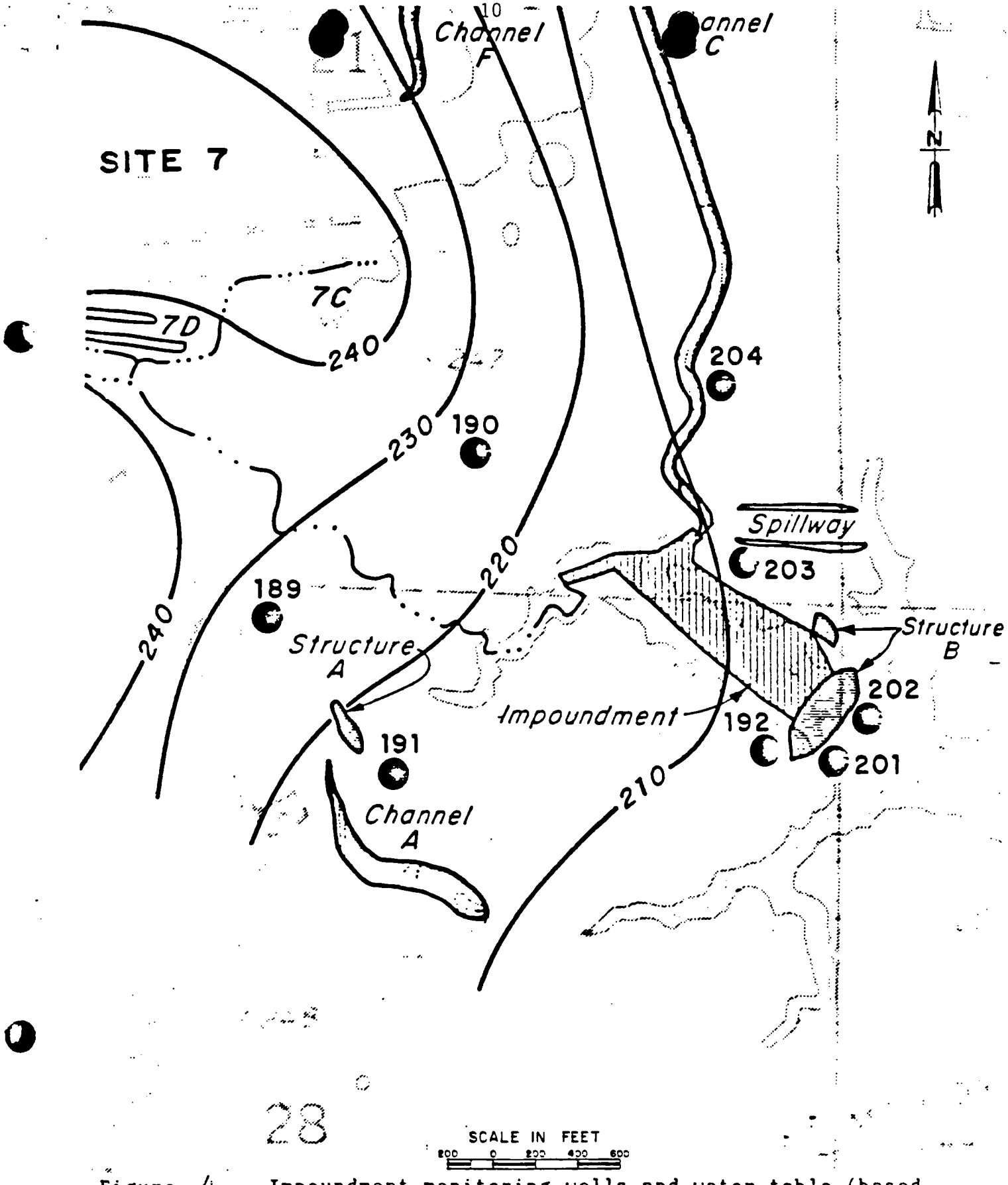


Figure 4. Impoundment monitoring wells and water table (based on December, 1984 readings)

The total organic carbon (TOC) levels in Well 201 were relatively high compared to the other wells. The March 1985 values for Well 201 was 18.0 and the values of the other wells ranged from 2.5 - 4.9. The total organic halogen (TOX) levels in Well 203 were relatively high (1.570 mg/l - 1.750 mg/l) compared to the other wells (0.028, 0.093).

High levels of TOX in Well 203 were reportedly due to the presence of chloroform and chlorobenzene. Chlorobenzene measured 160 ug/l in Well 203 but was below detectable limits (5.0 ug/l) in all of the other wells. PBA reports that chlorobenzene is the result of the DDT operations.

According to the PBA report, very low levels of the pesticides DDT and DDD occur in downgradient wells 201 and 202 (DDT was 0.17 and 0.11 ug/l for these wells respectively and DDD was .10 and .33 ug/l respectively).

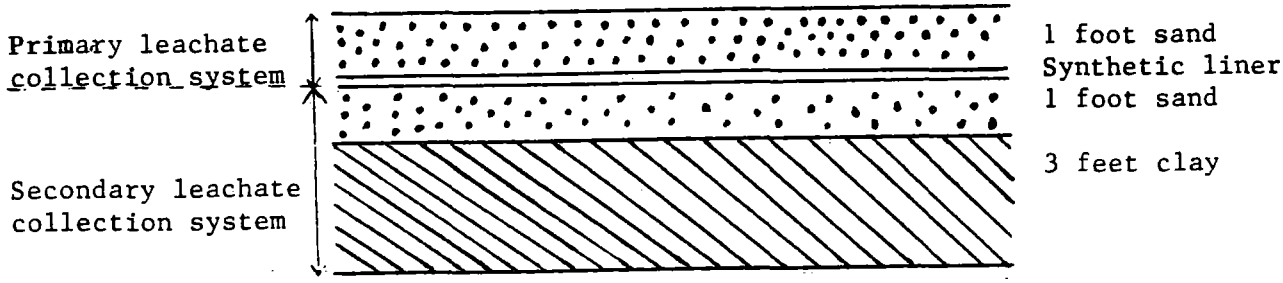
Since surface run-off had not been stored in the impoundment prior to the October 1985 inspection, the contamination could not have come from this unit. PBA suggests that the contamination possibly originates from adjacent farming operations and/or from Sites 7 and 11 where production, storage, and disposal of chemical agents and pesticides occurred.

The surface run-off control impoundment site should be moved into the assessment phase of groundwater monitoring to determine the extent of the groundwater contamination which could be emanating from Site 7, 11, or another PBA site.

1983 LANDFILL

Leachate Collection System

The 1983 landfill is equipped with a primary and secondary lechate collection system, and a roof to prevent surface run-on. The roof will be removed after the landfill is closed as per the closure plan. The landfill liner consists of a 3 foot thick clay cover overlain by one 1 foot of sand cover. Schedule 80 PVC perforated pipes are placed 25' feet into the sand, making it a secondary leachate collection system. A 36 mil synthetic liner is placed over the sand and one foot of sand is placed over the membrane. The primary leachate collection system, which is composed of schedule 80 PVC perforated pipes, is installed in this sand layer. A typical cross-section is as shown below.



Groundwater Monitoring Network

The groundwater monitoring system consists of 12 wells; 2 upgradient and 10 downgradient (Figures 5 and 6). About one half of the wells were damaged by heavy equipment during construction of the landfill cells. This damage varied from superficial to complete destruction. Thus, only about 6 wells were sampled on a regular quarterly basis.

The horizontal spacing and the point of compliance appear to be appropriate for detecting contamination at this landfill. The circular arrangement of the wells is appropriate since the ground water flows radially from the landfill site (Figures 5 and 6). The point of compliance is short enough that the wells should be able to detect contamination originating from the landfill.

The depth of the monitor wells is appropriate. All of the wells monitor approximately the upper two-thirds of the uppermost aquifer. Since the lower third of the aquifer is not monitored, the monitoring system is not adequate for the monitoring of "sinkers". However, "sinkers" should not be present at the site.

Each well is constructed of 4-inch diameter PVC pipe with noncemented joints, 0.010 inch slotted PVC screen, high volume electric submersible pump, and permanent well caps. Each well is completed with a cement grout annular seal, a bentonite clay annular seal, and sand packs adjacent to the well screen which is 5 feet in length. More than half of the sand packs are at least 20 feet in length (Figures 7, 8, 9, and 10).

The monitoring system is inadequate according to RCRA standards in the following areas.

- The excessive length of most of the sand packs allows excessive dilution which reduces the sensitivity of the monitoring system for detecting contaminants.

- All wells are inadequate for the effective collection of volatile samples (chlorobenzene) as described in the permit. The turbulence from the high volume submersible pump results in loss of volatiles which can result in false values. Bailers are the preferred method for collecting volatile samples, however permanent caps on the monitor wells prevent the usage of bailers.

- WELL 184 (downgradient)

  This well is inadequate because the excessive length of the sand packs (39 feet) causes excessive dilution which greatly decreases the ability of Well 184 to detect contaminants in the uppermost aquifer (Figure 8). Due to its location (downgradient of Well 178), Well 184 is not a necessary monitor well in this monitoring system (Figure 5).

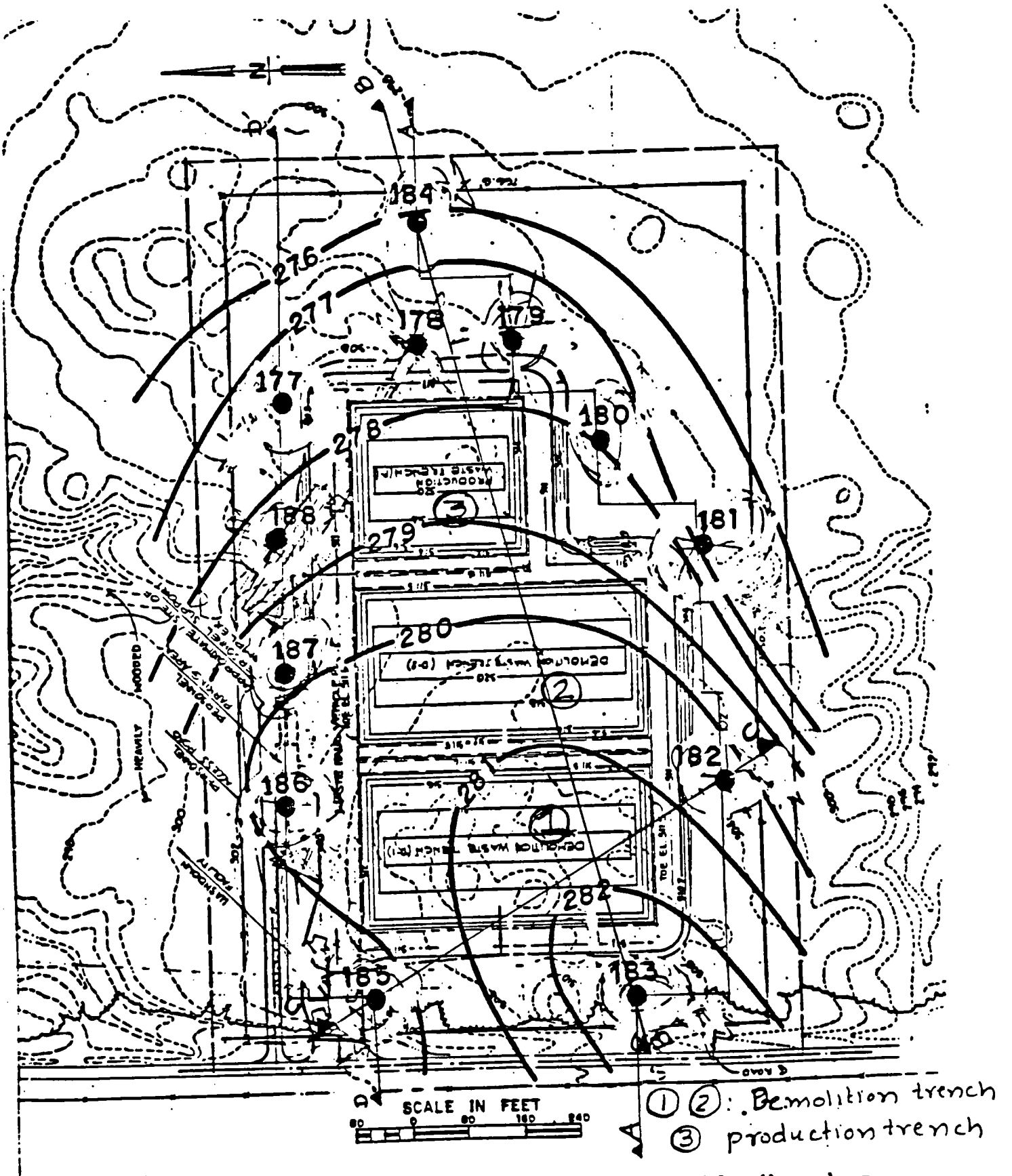
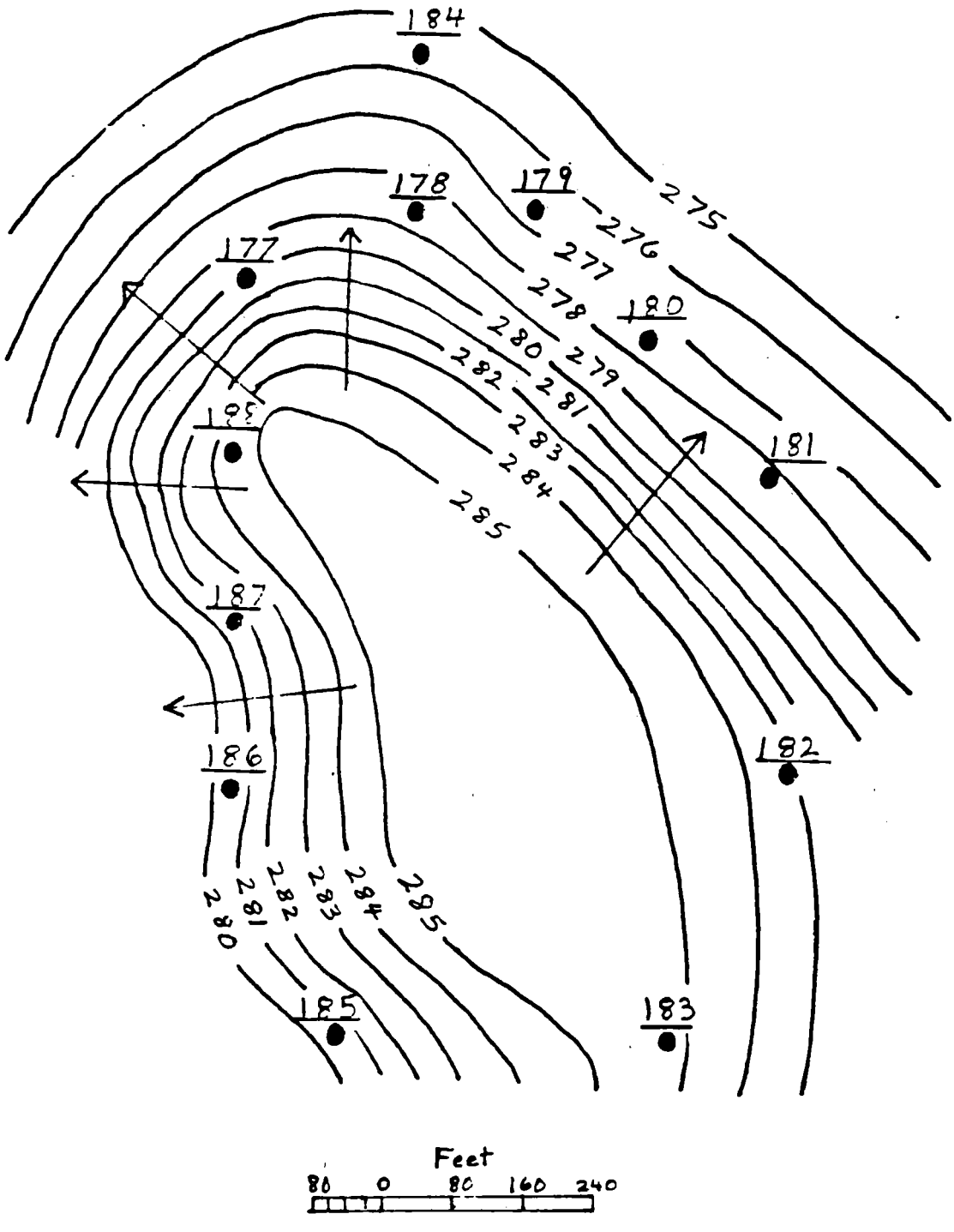


Figure 5 Landfill monitoring wells and water table (based on December, 1984 readings)



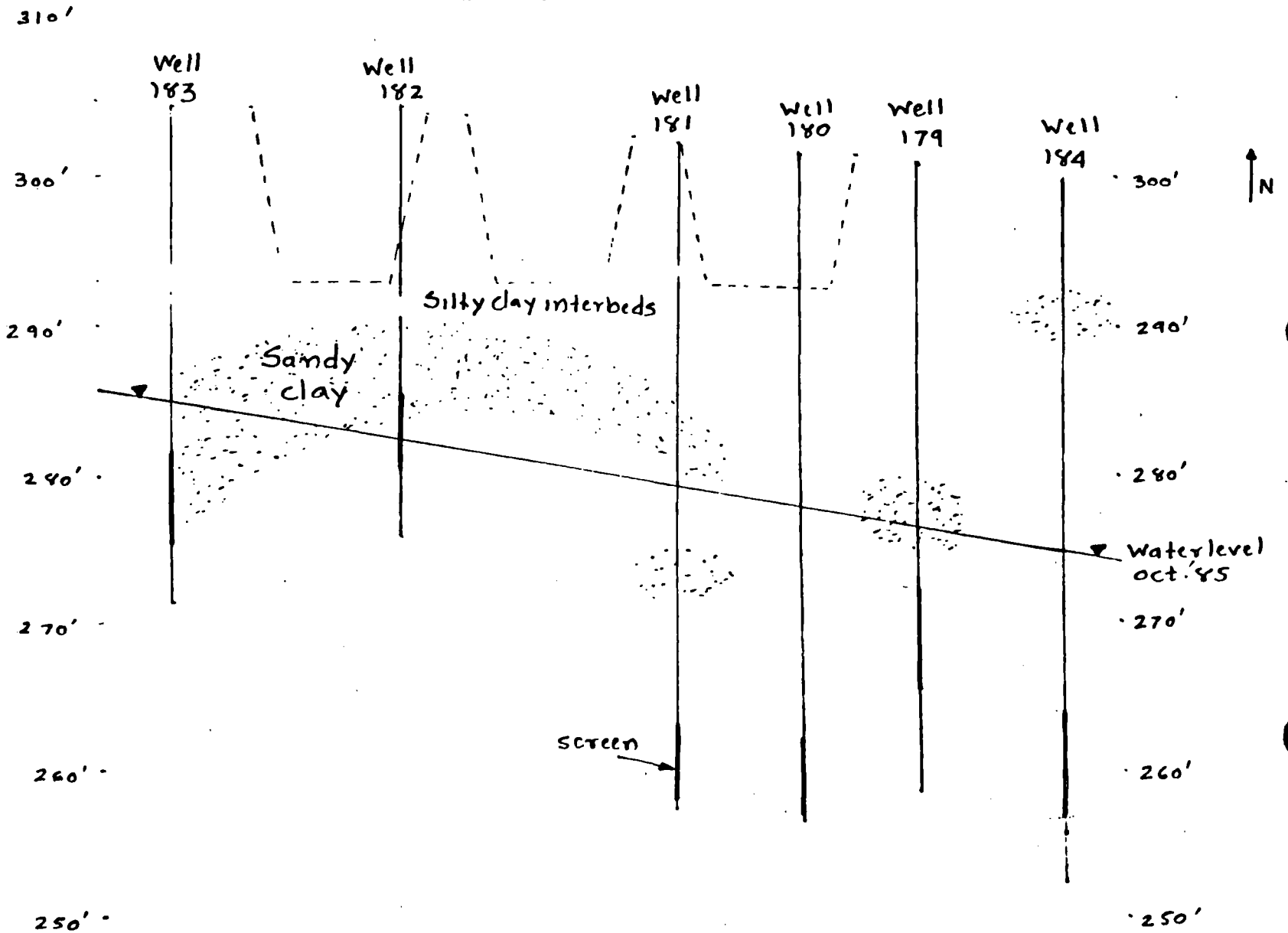
● 185 : Well Number

—285— : Potentiometric Contour

⟶ : Flow direction

Figure 6 : 1983 Landfill , ground water potentiometric contours and flow directions, October 1985.

Figure 7.



all wells 4"ϕ
all screens 5' long

PINE BLUFF ARSENAL
cross-section AA

Scale
Horizontal : 1" = 192'
Vertical : 1" = 10'

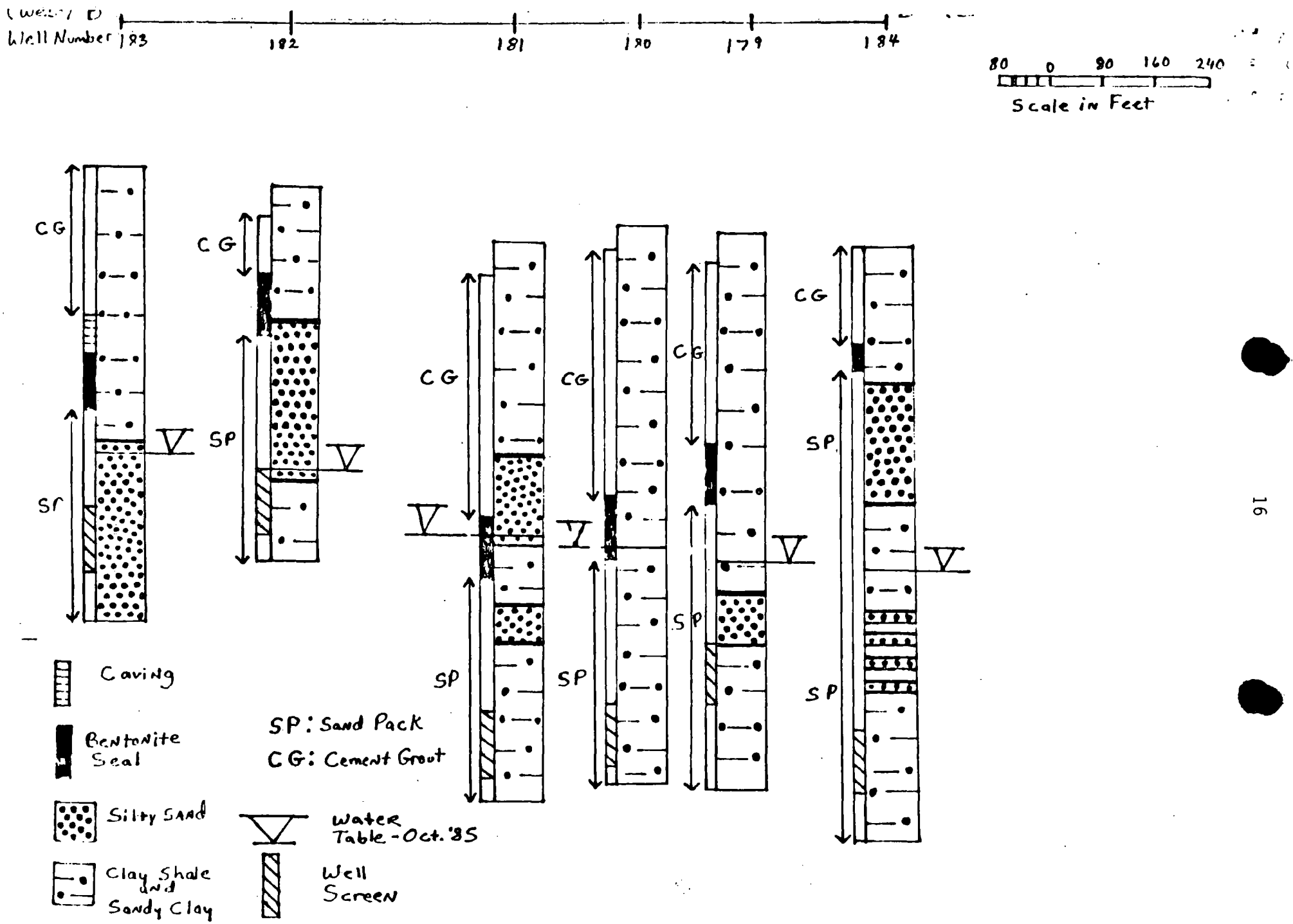


Figure 8 : 1983 Landfill PBA, B-B' Geologic Cross-section with Water Levels, October 1985.

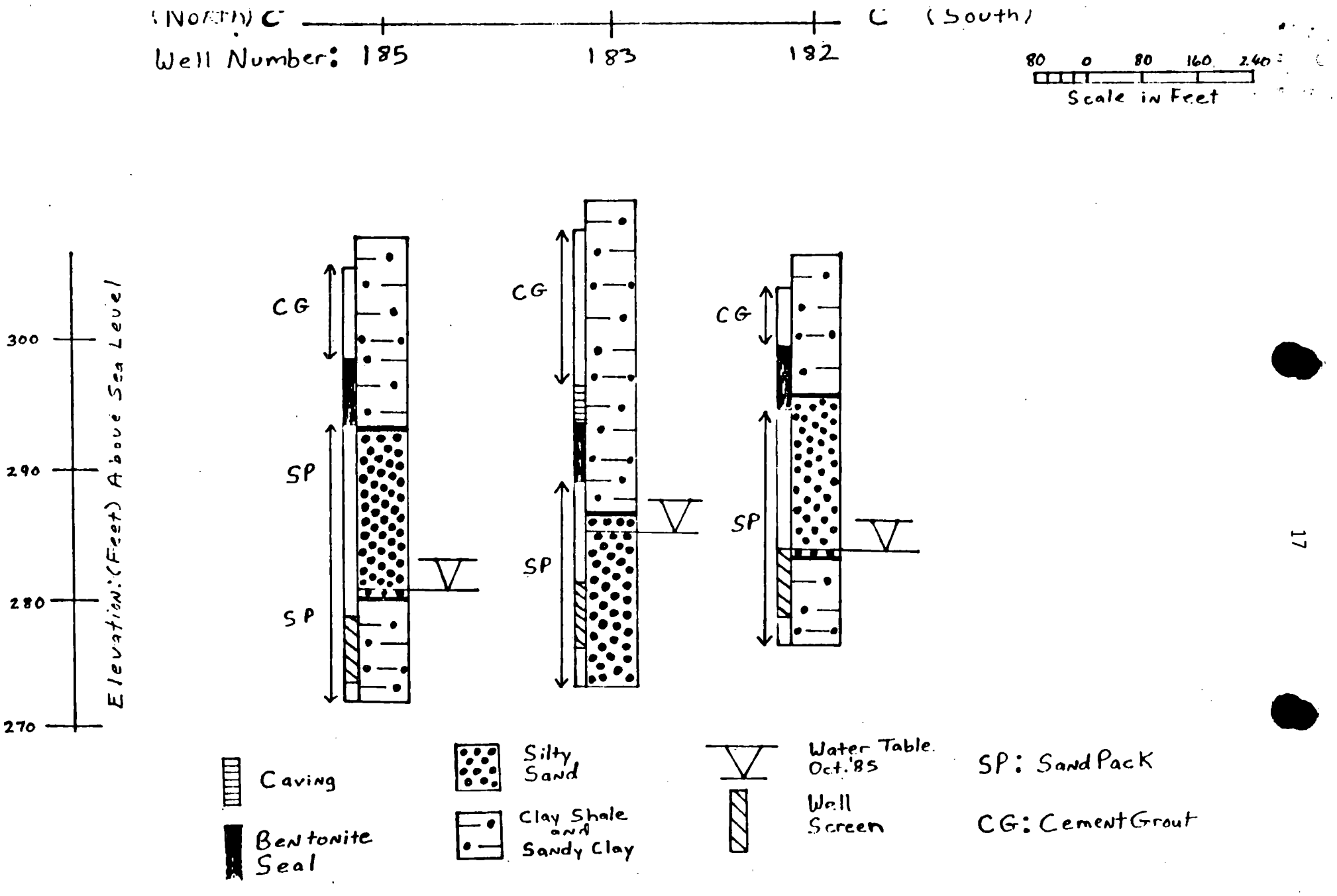


Figure 9. : 1985 Landfill PBA, C-C' Geologic Cross-section with Water Levels, October, 1985.

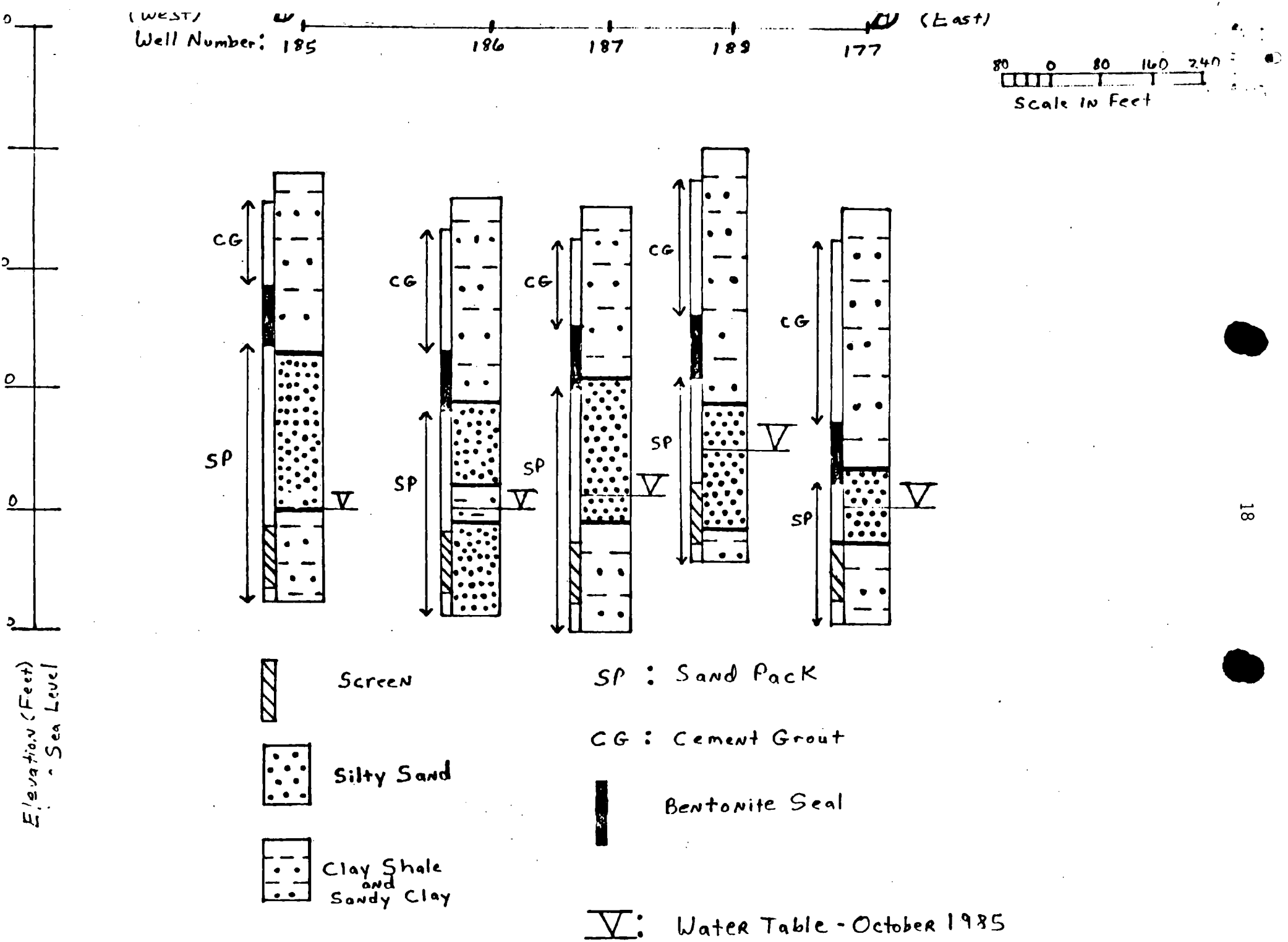


Figure 10: 1983 Landfill PBA, A-A' Geologic Cross-section with Water Levels, October, 1985.

° WELL 183 (upgradient)

This well is inadequate because it yields abnormal water quality data (abnormally higher pH levels) compared with the other wells at the site. The pH values are an important parameter for determining groundwater contamination. Improper pH is likely to lead to wrong conclusions regarding metal concentrations and contamination. It also affects the solubility of the metals being monitored. The higher pH cannot be attributed to the lithology, soil chemistry, and natural variation. Since no waste was placed in the Landfill until October 1985, the pH level could not be affected by the contents of the Landfill. During four quarters of monitoring, the pH varied from 12.0 to 11.7 (see Table 1). The average pH at this site is is 6.92. In addition, this well exhibited several fold higher barium content than the other wells and yielded turbid samples during the October inspection. The evidence indicates that the well does not represent natural groundwater quality and the well has been damaged, improperly installed or developed.

The high pH at this well can be attributed to dissolution of the cement grout which seals the annular space. The dissolution indicates an inadequate annular seal which results in an inadequate monitoring well and inaccurate groundwater quality data, especially background quality.

The data from this well should not be utilized to establish groundwater quality, especially background quality.

° WELL 182 (downgradient)

This well is inadequate because it yields abnormal groundwater quality samples. This well exhibited abnormal fluctuation of the pH levels (6.4 to 11. 2) which is an unusual phenomenon not occuring naturally in groundwater. Only two samples were obtained during four quarters of sampling which are not enough samples for statistical comparison. In addition, the PBA's consultant, Ford Thorton Norton & Associates, in the December 1984 report indicated that the casing is at a 20° angle and the well has been damaged. This well has also yielded very turbid samples. The high pH can be attributed to dissolution of the cement grout which indicates an inadequate annular seal, inaccurate water quality data, and inaccurate background water quality data. Data from this well should not be utilized to determine groundwater quality, especially background quality.

TABLE 1

1983 Landfill Monitoring Data

	Up Gradient		Down Gradient	
	183	185	188	187
pH				
May. 84	11.8	6.0	6.2	6.3
Oct. 84	12.0	5.7	5.9	5.6
Nov. 84	11.7	6.8	6.0	6.4
Mar. 85	11.9	5.6	6.8	6.7
Oct. 85	9.6	5.2	-	5.3
Chloride				
May. 84	12.0	24.0	14.0	57.0
Oct. 84	ND	27.0	7.8	72.0
Nov. 84	15.0	23.0	7.0	58.0
Mar. 85	18.0	23.0	12.0	54.0
Oct. 85	11.2	20.3	-	48.2
TOC - Total Organic Carbon				
May. 84	51.0	22.0	17.0	26.0
Oct. 84	13.0	6.0	3.0	4.0
Nov. 84	18.0	7.0	4.0	4.0
Mar. 85	15.0	6.3	4.3	2.3
Oct. 85	17.2	16.7	-	15.5
TOX - Total Organic Halogen				
May. 84	0.080	0.094	0.049	0.090
Oct. 84	0.085	0.095	0.053	0.046
Nov. 84	0.037	0.045	0.018	0.040
Mar. 85	0.049	0.063	0.041	0.052
Oct. 85	-	-	-	-
TDS - Total Dissolved Solids				
May. 84	378.0	192.0	212.0	420.0
Oct. 84	1374.0	280.0	254.0	456.0
Nov. 84	918.0	256.0	147.0	455.0
Mar. 85	351.0	276.0	239.0	474.0
Oct. 85	-	-	-	-

TABLE 1 CONTINUED

1983 Landfill Monitoring Data

	Up Gradient		Down Gradient	
	183	185	188	187
As - Arsenic				
May. 84	0.012	ND	ND	ND
Oct. 84	ND	ND	0.013	0.013
Nov. 84	ND	ND	ND	ND
Mar. 85	0.011	ND	ND	ND
Oct. 85	0.033	ND	-	0.011
Ba - Barium				
May. 84	0.5	ND	ND	ND
Oct. 84	2.99	ND	ND	ND
Nov. 84	1.21	0.08	0.11	0.19
Mar. 85	0.48	ND	ND	0.10
Oct. 85	0.16	0.03	-	0.07
Pb - Lead				
May. 84	0.017	0.081	ND	.012
Oct. 84	0.121	0.229	0.10	0.10
Nov. 84	0.036	0.134	ND	0.003
Mar. 85	ND	0.043	ND	ND
Oct. 85	0.328	0.738	-	1.45
Hg - Mercury				
May. 84	ND	ND	ND	ND
Oct. 84	ND	ND	ND	ND
Nov. 84	ND	ND	ND	ND
Mar. 85	ND	ND	ND	ND
Oct. 85	ND	ND	-	ND
Na - Sodium				
May. 84	66.0	27.0	63.0	30.0
Oct. 84	33.0	29.0	23.0	44.0
Nov. 84	45.0	30.0	20.0	68.0
Mar. 85	52.0	72.0	69.0	113.0
Oct. 85	19.5	26.5	-	61.0

° ND - Not Detectable

° All results are reported in Mg/l

° Underlined values exceed groundwater protection standard 40 CFR 264.94

° October 1985 results are from EPA laboratory, all other results as reported by PBA.

° WELL 181 (downgradient)

This well is inadequate because the position of the sand pack is not at appropriate depth to yield samples that are representative of the groundwater passing the point of compliance. The permit requires that the sand pack extend 5 feet above and below the water table (Permit, Attachment 9, Appendix F). However, the top of the sand pack is located four feet below the water table in October 1985 (Figure 8). The water table does not intersect the sand pack and thus it is not monitored as specified in the permit.

Another problem with the design of Well 181 is that the sand pack does not monitor a more permeable sandy zone which is a potential pathway for contaminant migration. This sandy zone intersects the water table zone and is illustrated in Figure 8. Contaminants could potentially move laterally along this unmonitored sandy pathway instead of downward and thus escape detection. Thus, this well is inadequate for the detection of contaminants passing the point of compliance.

RESULTS OF CME SAMPLING

The most recent laboratory results indicate significant exceedance of groundwater protection standards for lead (Pb) in the monitor wells, especially the upgradient wells 183 and 185 (Table 1). The lead contamination could have originated from either previous undocumented waste disposal at PBA, or from non-PBA property adjacent to the landfill. Additional monitor wells will be required to determine whether the lead contamination originates from PBA property or non-PBA property.

GENERAL GEOLOGY

The Jackson Group (undivided) comprises the uppermost aquifer and outcrops at the PBA 1983 Landfill site. Municipal, industrial, and domestic water wells which produce water from this aquifer are located be hydraulically upgradient and cannot be affected by the 1983 Landfill. Water quantity and quality data from these wells are not available.

Important aquifers in the PBA area include the Sparta Sand and various Quaternary alluvial aquifers. The Sparta Formation is one of the most productive aquifers in the region as well as the principle aquifer in the Pine Bluff area. The Sparta occurs at an approximate depth of 600 feet below the landfill site. The Landfill is not located in the Sparta recharge area which is hydraulically upgradient from the PBA landfill site. PBA has 10 wells that produce drinking water from the Sparta, however there appears to be low potential for these wells to act as conduits which could result in cross-contamination from the 1983 Landfill site.

The Quaternary alluvial deposits are important aquifers in the PBA area. However, no one uses water from these aquifers downgradient of the Landfill site. The 1983 Landfill site is hydraulically connected to Quaternary alluvial deposits located 725 feet to the east of the landfill cell (Cross-section C-C', Sheet 24 of the Permit Plans). This would be of concern if contamination was detected on the east side of the landfill because the highly permeable nature of alluvial deposits could cause rapid transport of contaminants.

SITE GEOLOGY

The subsurface geology at the site was analyzed to a depth of 100 feet using continuous core borings. The uppermost aquifer consists of interbedded sequences of sands, silts, and clays. It extends to a depth of approximately 50-70 feet below the surface. Discontinuous sand/sandstone units are present at shallow depths (10-25 feet below the surface) near the water table zone (Figure 7). Below the uppermost aquifer lies a clay aquitard which is reportedly acts as an impermeable barrier to groundwater flow. This clay aquitard which ranges in thickness from 25-30 feet is discontinuous throughout the PBA site but appears to be continuous at the landfill site. A sand/sandstone aquifer underlies the clay aquitard at a depth of approximately 100 feet.

HYDROGEOLOGY

The landfill is situated on a relatively high topographic area within the Arkansas River drainage basin (Figures 3 and 5). The ground water flows toward the landfill site from the west but at the site it flows downgradient in a radial pattern toward the north, south, and east (Figure 6). Since the CERCLA sites are located hydraulically downgradient from the landfill, the CERCLA sites should not contaminate the groundwater at the landfill.

There is both a shallow permanent water table and a seasonal perched water table at the site. In October 1985, the permanent water table ranged from approximately 22 to 25 feet below the surface. This seasonal perched water table is apparent at depths of one to five feet below the surface only during April through June. The perched water table would have intersected the landfill cells which would have been unacceptable to EPA. Therefore, french drains, pumps, and trenches were constructed to eliminate the perched water table and to maintain a distance of 10 feet between the bottom of the landfill and the permanent water table.

The water table is located in both the sand/sandstone and the clayey silt units (Figures 7 - 10). The wells monitor both the sand/sandstone and the clayey silt units. The permeability of the sand/sandstone, clayey silt unit, and the clay aquitard is low. However, the sand/sandstone unit is more permeable and has greater groundwater velocity than the other two units. Decreased clay content in the sand/sandstone unit results in a increase in the permeability and groundwater velocity.

The laboratory permeability values for the sand/sandstone unit ranged from 10^{-3} - 10^{-7} cm/sec but field permeability values were not obtained. The true permeability of the sand/sandstone unit is thought to be higher than indicated by the laboratory test. The reason is because laboratory permeability tests typically yield less accurate and lower values than field values. Field values are more indicative of the true permeability than laboratory values. Thus, higher and more accurate permeability values would have been obtained for the sand/sandstone unit if field permeability had been measured.

The laboratory permeability values for the clayey silt unit ranges from 10^{-5} - 10^{-9} cm/sec and field values ranged from 10^{-5} - 10^{-7} cm/sec.

One laboratory test yielded a permeability of 10^{-9} cm/sec for the clay aquitard. Field permeability values for the clay aquitard ranged from 10^{-6} - 10^{-7} cm/sec. The field values are considered to be more accurate than the laboratory values for the clay aquitard. The field permeability data indicates that the clay aquitard and the clayey silt have relatively similar permeability.

The permeability of the clay aquitard could be higher than indicated by the permeability tests. The driller's core logs indicate that fractures, slickensides, and solution cavities exist in this clay aquitard (Permit Plan Plate 37, Bore Hole (BH): 6A4C-275, 277, 278, 279; Plate 42, 8A6C-310; Plate 43, BH: 8A6C-312; Plate 44, BH: 8A6C-314; Plate 46, BH: 8A6C-318). These features could increase the permeability in the clay aquitard and allow movement of groundwater (and contaminants) from the uppermost aquifer to the aquifer underlying the clay aquitard. However, if these features are discontinuous, their effect on the permeability could be negligable.

There is no evidence that the clay aquitard acts as an effective barrier to groundwater flow. The field permeability data does not provide evidence of this. Pump tests could be used to determine if groundwater moves from the uppermost aquifer, through the clay aquitard, and to the aquifer underlying the clay aquitard. However, pump tests were not attempted and thus the integrity of the clay aquitard is unknown.

The groundwater velocity values indicate that the sand/sandstone unit has higher groundwater flow velocities than the clayey silt unit. The velocity data was obtained using the permeability data, an effective porosity value of 30%, and hydraulic gradient values of 0.02 to 0.03. The groundwater velocity of the sand/sandstone unit ranges from 2.1 feet/year to 31,536 feet/year (5.97 miles/year). The groundwater velocity of the clayey silt unit ranges from .002 feet/year to 315.4 feet/year.

The actual groundwater velocities could vary significantly from the computed velocities due to the highly variable distribution of the clay within the aquifer.

Neuman
AR 910

NOV 26 1985

Ms. Cheryl Terai, Manager
Compliance and Technical Assistance Branch
Arkansas Department of Pollution
Control and Ecology
Post Office Box 9583
8001 Nation Drive
Little Rock, Arkansas 72219

Re: Pine Bluff Arsenal
EPA I. D. No. AR0213820707

Dear Ms. Terai:

Enclosed is a copy of the inspection report completed by Region VI during its lead inspection at Pine Bluff Arsenal on October 21-23, 1985. It is noted that while Region VI conducted the lead inspection at the facility, ADPC&E is expected to initiate the enforcement action. Possible violations found at this facility include:

A. Containers Storage Checklist

1. Containers

° Containers holding hazardous waste are not in good condition (i.e. corroded).

Permit Condition III.A.3 pg. 17 / pg. 1 (Class I)

B. Groundwater Checklist

1. The collection, shipment, and chain of custody procedures and techniques for groundwater samples were not performed in accordance with permit conditions. Sampling procedures and techniques are found in Volume 2, Attachment 3, Appendix H.

Permit Condition III.G.2(a)(iv) pg. 23 / pgs. 3-5 (Class II)

° Sample equipment was not thoroughly cleaned between each sampling at each well.

Appendix H 5.(b) (3) (iii)

It was noted during the inspection that the temperature probe was not cleaned between sampling.

- Disposable gloves were not worn to minimize contamination and alleviate chemical spillage on the sampler's hands.

Appendix H 5.(c)(5)(ii)

- The possibility of volatilization of organic contaminates is not minimized by the methodology of sampling technique.

Appendix H 5.(b)(3)(i)

- No chain of custody procedures were maintained.

Appendix H 5.(d)(3)

C. Groundwater Monitoring Evaulation

1. A comprehensive groundwater monitoring evaluation is being finalized by Julie Wanslow, Environmental Protection Specialist of the Technical Section. This report will be mailed to you at a later date. However, the report found that the present monitoring system at the 1983 landfill does not meet the requirments of permit condition III.D.2 found on page 22 of the permit.

It was noted during the inspection that the solid waste storage area had a non-functional fire extinguisher (see Outbriefing narrative in the inspection report). The facility should be advised of this situation.

Based on the nature of the preceeding violations, EPA would issue this facility a RCRA §3008 Warning Letter.

Should you have any questions or comments, or disagree with our recommendations or findings, please feel free to contact me at (214) 767-9730 or have your staff contact Rosemary Martinez at (214) 767-9865.

Sincerely yours,

William H. Taylor, Jr., Chief
Enforcement Section (6H-CE)

Enclosure

bcc: H. Osgard 6H-CP
R. Hannangerslager 6H-EE
R. Brown 6H-P
B. Stendar 6H-PA
D. Peters 6E-SH
S. Schwartz 6H-CT

6H-CE:RMARTINEZ:rlh:Disk 1:Ltr to CTERAI:PINE BLUFF ARSENAL:11/20/85:

PINE BLUFF ARSENAL
FY 86 "CLOSE HAZARDOUS WASTE SITES"
PRELIMINARY CLOSURE PLANS

AR212/35207?

Site 2, Webster Road Test Site.

1. Site Description. The Webster road test site was used for testing DM, CM, and manganese grenades during the 1940's. The original extent of this site cannot be observed from the surface due to grading of the area. Previous investigations indicated that limited areas of contaminated soils were found at this site.

2. Geohydrology. No subsurface investigations were performed at site 2, but it is probably situated on Pleistocene terrace deposits consisting of silty clays, sandy clays, and silty fine sands. The Terrace deposits are underlain by the clay shale of the Jackson Group. Groundwater information is unavailable at the site, however, perched water could likely be encountered in some upper sand beds. The groundwater gradient is probably sloping toward the Arkansas River to the east.

3. Conceptual Closure Plan. The conceptual plan for closure consists of excavating the waste materials and contaminated soil and transporting them to a secure site, then backfilling, grading, and revegetating the site.

Site 4A, Burn Site at 504th Street.

1. Site Description. The abandoned 504th Street Burning Ground was used for burning explosives and other munitions-related wastes. The surface is covered with red, oxidized, melted steel and magnesium. Previous investigation identified a number of contaminants present in the subsoil including barium, cadmium, arsenic, lead, mercury and isomers of DDT. The occurrences of these contaminants were sporadic, rather than pervasive across the site. The lateral and vertical extent of the contaminants is unknown.

2. Geohydrology. Site 4A is underlain by a thin blanket of Pleistocene terrace deposits. The depth to groundwater is not known. The regional groundwater table slopes to the east toward the Arkansas River. Perched and/or seasonal water tables may be encountered.

3. Conceptual Closure Plan. The concept plan for closure consists of a temporary sediment retention basin (SRB), a perimeter ditch on the southeast boundary, removal of existing vegetation, grading, placement of an impervious soil cover, and revegetation.

Site 7C, Mustard Agent Burning Yard.

1. Site Description. The Mustard Agent Burning Yard is located on the banks of a small intermittent creek, a tributary of Phillips Creek. The 1/2 acre site is covered by a layer of ash and mustard agent residue. These materials are visibly volatile and emit irritating fumes. Previous investigations indicate that the soil beneath the site is contaminated with low concentrations of arsenic, chromium, mercury, zinc and sulfates but the lateral and vertical extent of these contaminants has not been defined.

2. Geohydrology. Site 7C overlies sediments of Pleistocene terrace deposits. The deposits consist of silty and sandy clays and silty sands. The permanent groundwater table is probably greater than 25 feet beneath the surface and flows east to southeast toward the Arkansas River. Perched and/or seasonal water tables may exist at less depth.

3. Conceptual Closure Plan. The closure plan consists of removing the mustard agent residue for either destruction or burial, compacting contaminated soil over an impervious liner, and covering the site with an impervious material.

Site 7D, Toxic Storage Yard Borrow Pits.

1. Site Description. Site 7D consists of two abandoned borrow trenches approximately 400 feet long by 50 feet wide which are filled with water. These pits were catchment basins for spills of various hazardous wastes from site 7A. The presence of arsenic, barium, cadmium, mercury and zinc in the sludge has been indicated by laboratory analysis. The extent of migration of contaminants from these pits has not been determined.

2. Geohydrology. Site 7D overlies Pleistocene terrace deposits consisting of sandy and silty clays and clayey sands. The groundwater table is probably greater than 25 feet deep. Perched and/or seasonal water tables exist at 8 to 12 feet in depth.

3. Conceptual Closure Plan. The concept plan for closure consists of channelizing the creek for discharge of water from the pits. This water will be treated if necessary. Waste materials and contaminated soil will be excavated and replaced between impervious liners.

where one sheets for 7a + 7b

Site 10, West Bomb Mat, Depot Demolition, Open Burning, and Storage and Disposal Area.

1. Site Description. Site 10 approaches 70 acres in size and has been used for a variety of purposes. The west bombing mat, formerly used for product testing, is currently used as a hazardous waste storage yard. To the west of the mat is a disposal area and a burning ground which contains considerable volumes of wood crates, demolished buildings, spent casings, disarmed grenades, chemical rocket propellors, and drums of chemicals. Several trenches have been excavated across the disposal area/burning ground, and the southernmost appear to penetrate the ground water table. These trenches are partially filled with debris and/or ashes. The west edge of the site drops off abruptly to a boggy area, the floodplain of Phillips Creek, a tributary to the Arkansas River. Anamolous concentrations of lead and mercury were encountered in soil samples taken at this site during previous investigations. The degree and extent of soil and ground water contamination beneath or adjacent to this site has not been determined.

2. Geohydrology. The west bombing mat is underlain by a thick, complex sequence of Pleistocene terrace deposits. The sediments consist of silty clays, silty sands and sandy clays. Perched water was encountered at 25 feet below the surface, and other perched or seasonal water tables may exist. The permanent water table is at approximately 35 feet.

3. Conceptual Closure Plan. The concept plan for closure consists of ditches and berms and a lined retention basin at the bombing mat. The disposal area and burning ground will require demolition of structures, removal of waste drums and removal of contaminants and contaminated soil to areas above the perched water table and limits of the 100-year flood. The site will be covered by an impervious cover and surrounded by ditches.

Site 12, Mustard Burn Pits.

1. Site Description. The abandoned Mustard Dump and Burn Site is located adjacent to the Arkansas River. A considerable portion of the site lies in the river's floodplain. The site measures approximately 150 feet long by 50 feet wide and is covered with burned, exploded, unexploded, and very weathered (rusted) mustard munitions. Additional parallel trenches exist which contain decomposed 50-gallon drums and grenade bodies which were used in the 1940's. The degree and extent of soil and groundwater contamination resulting from this waste site is not known.

2. Geohydrology. Site 12, the Old Mustard Burning Site, is located adjacent to the Arkansas River on Recent river alluvial deposits. No subsurface investigations were conducted, however, groundwater is most likely shallow, occurring at elevation near river level. Some seasonal perched water may occur after heavy rainfall.

3. Conceptual Closure Plan. The concept plan for closure consists of removing surficial debris, backfilling, and revegetation.

Site 13A, Abandoned Burn Pit.

1. Site Description. The abandoned Burning Site is approximately 12 acres in extent. Previous investigations found minor heavy metal (lead and zinc) and DDT contamination at the site. Investigations to confirm that the contaminated soils remaining at the site pose no unusual environmental dangers will be required.

2. Geohydrology. The abandoned Burning Site (13A) is located on a thick sequence of Pleistocene terrace deposits. No investigations have been conducted at the site, however, the permanent groundwater table is probably about 30 to 35 feet deep and flows toward the Arkansas River to the east. Shallow perched and/or seasonal water tables are likely to exist.

3. Conceptual Closure Plan. The concept plan for closure consists of temporary sediment retention basins around the site periphery, removal of vegetation, grading and placement of compacted fill to promote runoff, and placement of an impervious cover.

Site 16A, White Phosphorus Landfill.

1. Site Description. The abandoned white phosphorous settling pond was constructed as a flow-through basin receiving phosphorous-laden wastewaters from production areas. Its use was terminated in 1978, and it has subsequently been covered over with soil and rock material. Unknown quantities of highly reactive phosphorous are suspected to remain at the site. Observations of strong chemical reactions were made during previous drilling and sampling operations, and spontaneous fires have reportedly occurred at the site. A small stream flows along the edge of the site. The site's subsurface and hydrogeologic conditions have not been investigated.

2. Geohydrology. The White Phosphorus Landfill is situated upon Pleistocene terrace deposits. Borings for ground water monitoring wells in the general area indicate terrace deposits of fine sands and sandy clays in excess of 50 feet in thickness. The regional groundwater table occurs approximately at elevation 200 NGVD (approximately 45 feet below ground at the site). The regional ground water table gradient slopes to the east toward the Arkansas River.

3. Conceptual Closure Plan. The closure plan consists of channelizing the adjacent stream, and covering the area with fill and an impervious cover.

Site 17, Product Assurance Test Range and Dump Site.

1. Site Description. Site 17 was previously used for testing smoke grenades and disposal of refuse, such as expended smoke grenades and pyrotechnical devices. The testing range is a shallow, impervious basin draining into a sump. Precipitation falling on the test range enters the sump and is then transported to the PBA pollution abatement facility. The dump site is located along the shore of Yellow Lake. An erosional escarpment plunges from the general elevation of the test range and surrounding area (242 feet) to the level of the pond (202 feet). Considerable volumes of debris have been dumped over this excarpment and into the small ravines which dissect it. The debris extends nearly to the lake margin at the toe of the slope. The extent of possible contamination of soil, groundwater, and surface water resulting from dumping over this escarpment has not been adequately defined. It is possible that the major impacts of this uncontrolled dumping are limited to shallow soil contamination and surficial leachate entering the lake. Whether or not this actually occurs is dependent upon the site's hydrogeologic conditions.

2. Geohydrology. The top and the face of the dump site rest upon Pleistocene terrace sediments; the foot of the dump rests on Recent alluvium. The alluvial deposits are annually flooded by overflow from Yellow Lake. At site 17, ground water moves east-northeast to Yellow Lake.

3. Conceptual Closure Plan. The concept plan consists of a sediment retaining structure along the toe of the slope, diversion of surface water, removal of the debris and contaminated soil, backfilling to a uniform grade and covering with an impervious material.

Site 20A, Depot South Burning Pit.

1. Site Description. Site 20A consists of the the 5-acre depot south burning pit and the adjacent hazardous waste storage area. In the past, the area was used as an old burning area and dump site for materials contaminated by their association with pyrotechnic materials. Hundreds of rusted 55-gallon drums of various wastes are stacked indiscriminately about the area. There is evidence of spills and there are no dikes to contain such spills. The deposits in this area rim a swampy wetland. Chemical analysis of soil samples from preliminary borings indicate a wide distribution of lead contamination and lesser concentrations of barium and cadmium beneath the site. These borings also indicate the existance of a clay layer beneath the site which, if pervasive, would form a suitable foundation for shallow cutoff walls. Geotechnical investigations to further define the geohydrology of the site will be required.

2. Geohydrology. Site 20A overlies Recent alluvium (meander belt deposits) composed of clays (CH and CL). The site is situated on a surface fill of 5-10 feet thick. The fill is the result of dumping at the site. Ground water is very shallow at the site, occurring in the fill material at the same elevation as in an adjacent swamp. Ground water flows northeast to the swamp and thence to the Arkansas River.

3. Conceptual Closure Plan. The concept plan for closure consists of diversion and retention levees, a retention reservoir, removal of containers and contaminated debris, and placement of an impervious cover. The impervious cover will be keyed into the shallow clay layer along the perimeter of the site.

Site 20B, White Phosphorus Slag Burning and Disposal Area.

1. Site Description. Site 20B is a relatively small area formerly used as a white phosphorous slag burning and disposal area. The site is littered with rusted 55-gallon drums, wooden pallets, and other debris. The soil stratigraphy and degree and extent of contamination of this area have not been determined.

2. Geohydrology. Site 20B overlies Recent alluvium (meander belt deposits) composed of clay (CH and CL). The site is situated on a surface fill of 5-10 feet thick. The fill is the result of dumping at the site. Ground water is very shallow at the site, occurring in the fill material at the same elevation as in an adjacent swamp. Ground water flows northeast to the swamp and thence to the Arkansas River.

3. Conceptual Closure Plan. The concept plan for closure consists of removing surface debris and hazardous materials, construction of diversion trenches, and adding an impervious cover.

Site 23A, White Smoke Test Pond.

1. Site Description. The White Smoke Test Pond is used for testing smoke pots and grenades. Spent munitions resulting from these activities and other waste materials are deposited at the site. Previous investigations revealed that the soils at this site are contaminated with arsenic, lead, and mercury. Characteristics of the sludge and wastewater contained in this 1.5-acre test pond and extent of soil and ground water contamination are unknown.

2. Geohydrology. The White Smoke Test Pond is situated on a thick sequence of Pleistocene terrace deposits. Drilling showed the sequence to be at least 55 feet thick containing two water bearing zones. It is assumed that the local gradient parallels the regional gradient to the northeast.

3. Conceptual Closure Plan. The conceptual plan consists of a hydraulic barrier around the site which is keyed into an underlying clay bed. The site will be dewatered and covered with fill and an impervious cover.

Site 24, Thermite Disposal Area.

1. Site Description. The Thermite Disposal Area, presently classified as an open dump, is used for disposal of thermite waste generated by the Quality Assurance Drop Tower and lead oxide waste from the Bomb Washout Facility. Previous investigations at this 4-acre site revealed that a significant portion was contaminated with heavy metals, including barium, lead, and mercury. Contamination was detected at the maximum depths sampled (approximately 10 feet). The geohydrology and extent of contamination has not been adequately defined.

2. Geohydrology. The thermite disposal site is situated upon terrace sediments whose thickness is in excess of 50 feet. These deposits consist of alternating beds of silty fine sand and sandy clay. An upper sand unit, persistent throughout the area, contains perched ground water supported by an underlying impervious clay. This water was encountered at depths between 10 and 15 feet below ground level. The depth to the static water table ranges from 31 to 35 feet below ground surface at approximately elevation 200 feet NGVD. This elevation is relatively consistent throughout the entire area with the ground water gradient sloping in the direction of the Arkansas River to the northeast.

3. Conceptual Closure Plan. The concept plan for closure consists of temporary sediment retention basins, site grading, and a clay cap. The area will be revegetated.

Site 27, Agent BZ Pond.

1. Site Description. The Agent BZ pond site is comprised of an unlined, 1/4-acre lagoon and the immediate surrounding area. The lagoon received the following wastes while in use: decontaminated Agent BZ, impregnite, thermite, and lead oxide (bomb washout of starter mix). Soil samples indicate that anamalous concentrations of lead, barium and zinc are found at this site. The vertical and lateral extent of the contaminants and the site geohydrology have not been fully defined.

2. Geohydrology. The Agent BZ Pond is situated upon terrace sediments whose thickness is in excess of 50 feet. These deposits consist of alternating beds of silty fine sand and sandy clay. The depth to the static water table ranges from 31 to 35 feet below ground surface at approximately elevation 200 feet NGVD. This elevation is relatively consistent throughout the entire area, with the groundwater gradient sloping in the direction of the Arkansas River to the northeast.

3. Conceptual Closure Plan. The concept plan for closure consists of run-on diversion trenches around the site, treatment of the lagoon water if necessary, encapsulation of contaiminated soil from the lagoon between impervious layers, and revegetation.

Site 29, Solid Waste Arkla Site.

1. Site Description. Site 29 consists of approximately 40 acres of partially cleared land which formerly contained a chlorine production facility. The buildings, tanks, and other production equipment have been removed. Soil sample analyses indicate anomalous levels of arsenic, lead, and mercury. The extent of soil and ground water contamination is not known.

2. Geohydrology. The Solid Waste Ark-La Area is situated on a thin blanket of terrace deposits overlying the shales of the Jackson Group. There is a possibility of perched water occurring in some upper sand strata. Depth to the regional water table is approximately 65 feet. The regional ground water gradient is to the east.

3. Conceptual Closure Plan. The plan consists of diversion trenches and drainage swales to control runon/runoff, a storm water reservoir, and revegetation.

Site 29A, Salt Pile.

1. Site Description. Site 29A consists of a salt pile associated with a former chlorine production plant. The pile has a volume of approximately 100 cubic yards and has been spray-covered with asphalt. Analysis of the pile has revealed low concentrations of cadmium, chromium, lead, and silver. The extent of contaminated soil has not been determined.

2. Geohydrology. The salt pile is situated on a thin blanket of terrace deposits overlying the shales of the Jackson Group. There is a possibility of perched water occurring in some upper sand strata. Depth to the regional water table is approximately 65 feet. The regional ground water gradient is to the east.

3. Conceptual Closure Plan. The plan consists of removal of the salt and contaminated material, grading, and revegetation.

Site 38, Impregnite Sludge Lagoon.

1. Site Description. The impregnite sludge lagoon contains impregnite mix and chloroethylene solvent stripper. This impoundment is approximately 30 feet square, 15 feet deep, and unlined. The lagoon is estimated to contain approximately 300 cubic yards of sludge. The site's subsurface and groundwater conditions have not been investigated.

2. Geohydrology. The Impregnite Sludge Lagoon is situated upon terrace sediments whose thickness is in excess of 50 feet. The depth to the static water table is approximately 31 to 35 feet below ground surface at approximately elevation 200 feet NGVD. This elevation is relatively consistent throughout the entire area, with the groundwater gradient sloping in the direction of the Arkansas River to the northeast.

3. Conceptual Closure Plan. The plan consists of filling in the pond, covering with a clay liner, and revegetating.

Site 26, Product Assurance Drop Tower

1. Site Description. The Drop Tower Test Basin is a shallow, concrete-lined structure surrounding a drop tower. The site has accumulation of spent grenades and slag contaminated soil containing anomelous concentrations of barium, lead, zinc, DDT, and dyes. The drop tower will remain an active facility.

2. Geohydrology. The Drop Tower Test Basin is situated upon terrace sediments whose thickness is in excess of 50 feet. These deposits consist of alternating beds of silty fine sand and sandy clay. The depth to the static water table is 35 feet below ground surface at approximately elevation 200 feet NGVD. This elevation is relatively consistent throughout the entire area, with the groundwater gradient sloping in the direction of the Arkansas River to the northeast.

Conceptual Plan for Upgrading. The conceptual plan consists of excavating all contaminated material outside the basin and transporting this material to a secure chemical landfill. The excavated area will be backfilled, graded to promote run-off and revegetated.

Site 31B, Grenade Test Basin

1. Site Description. The Test Basin is a shallow, concrete-lined structure located on the edge of a small pond. The basin has accumulation of spent grenades and slab precipitation falling into the basin drains into an industrial sewer and is transported to the pollution abatement facility.

2. Geohydrology. The Grenade Test Basin is situated on a thick sequence of Pleistocene terrace deposits. Drilling showed the sequence to be at least 55 feet thick containing two water bearing zones. A perched water table was encountered at a depth from 4.5 to 6.0 feet below ground level in an upper silty sand bed. The water table occurs deeper in a lower sand strata near elevation 200 feet NGVD. It is assumed that the local ground water gradient parallels the regional gradient to the northeast.

3. Conceptual plan for upgrading. The conceptual plan consists of excavating all contaminated material outside the basin and transporting it to a secure chemical landfill.

PINE BLUFF ARSENAL
"CLOSE HAZARDOUS WASTE SIT
SUMMARY OF SITES

No.	Site	Use	Probable, Suspected or Known Soil Contaminants
2	Webster Rd. Test Site	DM,CM, mang. grenades	Heavy Metals
4	504th St. burn site	Burning explosives & munitions	As,Ba,Pb,Hg,DDT
7a *	Old Toxic Storage Yard	Current Storage for pesticides & decontamagents	lots
7b *	Lewisite disposal area	Unlined sludge lagoon	As,Se,lewisite
7c *	Mustard agent burning yard		Mustard,As,Cr,Hg,Zn
7d *	Toxic Storage yd. borrow pits	Catchment basin for 7a	
10 *	Bombing Mat. & disposal area	Barrels of chemicals on a Concrete apron and adj. trenches	Pb,Hg
12 *	Old mustard dump yard	Disposal of munitions	Mustard
13A	McCoy Rd. burning pit		Pb,Zn,DDT
16A	White phosphorus landfill	Settling basin	P,Hg,Pb
17 *	Product assurance dumpsite	Disposal of grenades & pyrotechnical devices	As,Pb,Hg,DDT
20A *	South burning pit	Open dump	Pb,Ba,Cd,explosive compounds
20B	White phosphorus slag Disposal area	drums & WP debris	Pb
23A *	White smoke test pond	Pond for testing smoke pots and grenades	As,Pb,Hg,Low pH
24 *	Thermite disposal site	Open dump for thermite Pb oxide waste	Thermite, Ba,Pb,Hg
27 *	Agent BZ pond	Pond	BZ,impregnite, thermite PbO2,Pb,Ba,Zn
29	Solid Waste Ark-La Site	Chlorine production facility	As,Pb,Hg,Cl
29A	Salt Pile	100 Cu yds. salt covered w/asphalt	Cd,Pb,Cr,Ag
31A	Product assurance test site	Testing smoke grenades	Heavy metals, DDT
34	NCTR Equilization Pond	Lagoon w/NCTR sludge	

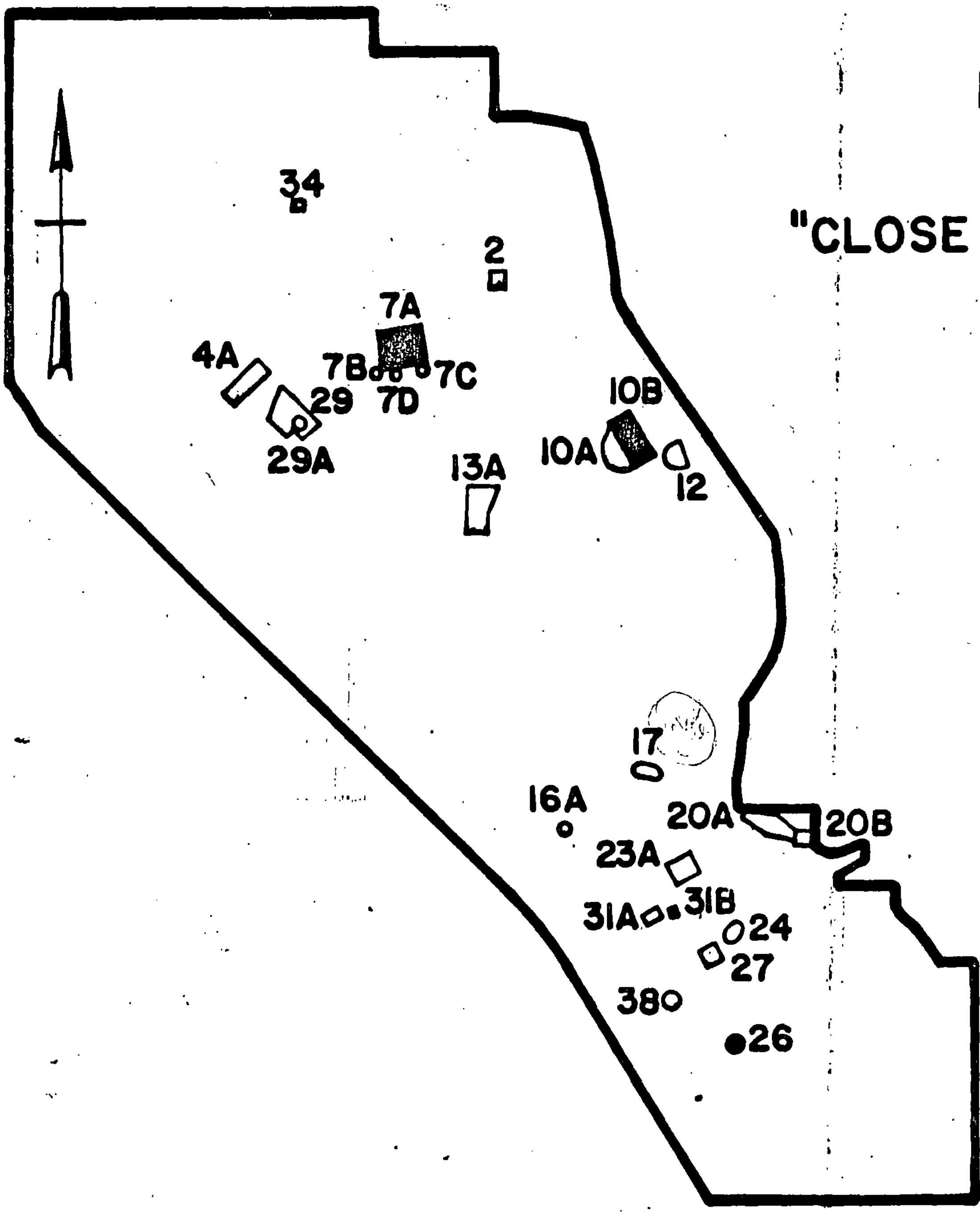
* In groundwater monitoring program.

No.	Site	Use	Probable, Suspected or Known Soil Contaminants
38 *	Impregnite Sludge Lagoon	Unlined lagoon	Impregnite, chloroethyle solvent
26	Product assurance drop tower	Concrete-lined structure w/spent grenades & slag	
31B	Grenade test basin	Sim to 26	

wells up & dn gradient threat?

Capped? Rain water on top / sludge 30 X 30 X 5

PINE BLUFF ARSENAL
FY 86 PROJECT
"CLOSE HAZARDOUS WASTE SITES"



LEGEND

SITE CLOSURE

RUNON/RUNOFF CONTROL ONLY

SCALE OF FEET
2000 0 2000 4000

Joe Georg
8-475-8103

PINE BLUFF ARSENAL
FY 86 PROJECT
CLOSE HAZARDOUS WASTE SITES
PROPOSED PRIORITY OF INVESTIGATION

SITE NUMBER	SITE DESCRIPTION
20A	DEPOT SOUTH BURNING PIT
10A	DEPOT DEMOLITION AND OPEN BURNING
10B	BOMBING MAT
7A	OLD TOXIC STORAGE YARD

7B	LEWISITE DISPOSAL AREA
7C	MUSTARD AGENT BURNING YARD
7D	TOXIC STORAGE YARD BORROW PITS
17	PRODUCT ASSURANCE TEST RANGE AND DUMP SITE
12	MUSTARD BURN PITS
20B	WHITE PHOSPHORUS SLAG BURNING AND DISPOSAL AREA
16A	WHITE PHOSPHORUS SETTLING POND AND LANDFILL

2	WEBSTER ROAD TEST SITE
4	BURN SITE AT 504TH STREET
13A	ABANDONED BURNING PIT
23A	WHITE SMOKE TEST POND
24	THERMITE DESPOSAL SITE
26	STANDBY DROP TOWER TEST BASIN
27	AGENT BZ POND
29	SOLID WASTE ARK-LA SITE
29A	SALT PILE
31A	PRODUCT ASSURANCE TEST SITE

31B STANDBY GRENADE TEST BASIN

34 NATIONAL CENTER FOR TOXICOLOGICAL RESEARCH EQUALIZATION POND

38 IMPREGNITE SLUDGE LAGOON